UNITED STATES DISTRICT COURT
MIDDLE DISTRICT OF FLORIDA
ORLANDO DIVISION

FOLIAR NUTRIENTS, INC.

Plaintiff, CASE NO. 6:04-CV-00346-JA-DAB

v.

PLANT FOOD SYSTEMS, INC.

Defendant

REBUTTAL BY ROBERT C. ADAIR, JR. OF DEFENDANT'S EXPERT REPORT

OVERVIEW OF REPORT

Having read the Expert Report of Michael David Coffey, PhD, FTCD, (the Coffey Report) and considered the references relied upon therein; I offer the following comments in rebuttal to that report.

My name is Robert C. Adair, Jr., and I am the Executive Director of the Florida Research Center for Agricultural Sustainability, Inc. (FLARES) located at 7055 33rd Street, Vero Beach, FL 32966. This testimony is not provided in context of my official capacity with FARES. I work with Foliar Nutrients, Inc. in the capacity of a consultant. I have been asked to serve as an expert witness on behalf of Foliar Nutrients to rebut the Coffey Report. The attached Exhibit A is my *curriculum vitae* and includes a list of publications that I have authored in the last ten years. I have not testified as an expert witness within the last four years, either at trial or by deposition.

QUALIFICATIONS AS A WITNESS

I have an extensive background in agricultural research and sustainable agriculture, as well as experience in citrus production, biochemistry and farming. I am an active researcher in the fields of bio-control strategies for the citrus root weevil *Diaprepes abbreviatus*, foliar fertilizers, and the use of natural based bio-stimulants such as seaweed extracts, alpha-keto acids, humates, and fermentation products to increase plant vigor, pest resistance and crop yields.

I received a BS in Chemistry and Biology from the University of Miami in 1970. I worked for seven years as a research chemist at the University of Miami Medical School and the Miami VA Hospital Research Service, and then pursued graduate studies

in fisheries management at Oklahoma State University. While in Oklahoma, I developed and managed a 600-acre family farm raising registered Black Angus cattle using sustainable agricultural practices. Concurrently, I was the owner and manager of Phoenix Construction Company, which specialized in energy conservation and passive solar design. I became a member of the Kerr Center's Board of Trustees in 1985, and this was in recognition of my agricultural accomplishments,.

I currently supervise a project for the evaluation of foliar fertilization as a Best Management Practice (BMP) for citrus. This project seeks to determine if nutrients applied foliarly can reduce the amount of agricultural nutrients entering Florida's coastal water bodies while maintaining economic profitability for the grower. In addition, I have developed and demonstrated a sustainable program for citrus that reduces agricultural inputs. This program has reduced deleterious inputs while assuring an environmentally-safe agricultural program without compromising crop production or profitability.

Currently, I am the citrus coordinator for over 700 acres of citrus groves using the Sustainable Citrus Program (SCP) at the U.S. Fish & Wildlife's Merritt Island National Wildlife Refuge in Titusville, Florida. I have various research projects that have been funded by the State of Florida, citrus grower's checkoff grants, and the private sector. I have authored numerous scientific papers, which are shown in Exhibit A. I also provide agricultural consulting services to agricultural companies, develop fact sheets and reports on new agricultural materials for citrus, and am a frequent speaker at Florida citrus grower meetings. I am a graduate of Class II of the Florida Leadership Program for Agriculture and Natural Resources and Class I of the University of Florida Natural Resource Leadership Institute.

INFORMATION CONSIDERED IN PREPARING REPORT

I have considered the Coffey Report of Michael David Coffey together with the Information that is identified on pages 5-8 thereof as having been considered by Dr. Coffey in preparing his Report. I have also considered additional references as noted below in context of the rebuttal discussion.

OPINION AND BASIS FOR OPINION

The Coffey Report Reaches No Conclusion That The Use Of Phosphate In Combination With Phosphate Has Any Definite Or Repeatable Effects

In stating a conclusion as to obviousness on page 17 of the Coffey Report, Dr. Coffey equivocates that the phosphates "did not necessarily" inhibit the phosphonates and they "may enhance" the efficacy of phosphonates. Thus, Dr. Coffey's equivocation admits there was uncertainty in the art over whether the combination would actually work. This is also seen on page 13, i.e., "[i]n our own research we discovered variously inhibitory, neutral, and stimulatory effects of PO_4 (phosphate) on PO_3 (phosphonate, phosphite) activity against *Phytophthora*." In other words, the body of art as a whole provides conflicting laboratory results, such that those skilled in the art could not say whether the combination of phosphate with phosphonate inhibited *Phytophthora*, did nothing against *Phytophthora*, or stimulated *Phytophthora*. This is actually a strong factual position that supports the nonobviousness of what is claimed.

The remarks to follow show this uncertainty to be true in context of the prior art as a whole. Various researchers were investigating the effect of extremely dilute concentrations of phosphate because certain strains of *Phytophthora sp.* demonstrated

different sensitivities to phosphonates based on uptake kinetics that were of academic interest. Considering the entire body of art, the uptake kinetics of phosphonate were shown to be overwhelmed by the phosphate concentrations that are claimed, which were never investigated because the phenomenon disappeared at higher concentrations that were under investigation. In context of this art, what is claimed addresses a different and more effective response than was investigated, and so has achieved widespread commercial success. Therefore, what is claimed cannot be obvious because the art teaches away from what is claimed.

It is important to note that Dolan & Coffey reported this "enhancement effect" only on two mutant strains of *Phytophthora palmivora* "PO376" and "L3" that showed an exceptional resistance to phosphonate. These mutant isolates, PO376 and strain L3, do not represent typical field populations of normally occurring *Phytophthora sp.* Therefore the results observed would not be typical or expected for field populations of the same pathogen. Moreover, previous publications by Coffey as well as other scientists all observed inhibitory effects of phosphate on the activity of phosphonates on *Phytophthora sp.* Or stated another way, the body of scientific publications investigating the effects of phosphate on phosphonate as a fungicide were all inhibitory which teaches against the claims of the patents at issue.

Dr. Coffey himself has published articles documenting failure of phosphates and phosphates in combination to control fungi at dilute concentrations. The Coffey Report has considered **M.E. Fenn and M.D. Coffey 1984** "Studies on the in vitro and in vivo antifungal activity of fosetyl-Al and phosphorous acid." PHYTOPATHOLOGY 74: 606-611. This report (Fenn & Coffey) presents data where different fungi were grown on

Ribiero's medium that contained 69 µg/ml Phosphonic Acid and was supplemented with 100-fold increases of phosphate concentrations to assess its effect of on the percent inhibition of fungal growth produced by the fungicidal activity of phosphonic acid:

TABLE 4. Percentage growth inhibition of various fungi on Ribeiro's synthetic agar medium (RMSM) containing 0.84 m M H_3PO_3 (69 µg/ml) at three phosphate concentrations

Fungus	Percentage inhibition of radial growth[a] at KH_2PO_4 concentrations (mM) of: 0.084	0.84	8.4
Phytophthora cinnamomi (Pc356)	100 a	93 a	90 a
Pythium aphanidermatum	53 b	56 b	31 b
Rhizopus stolonifer	32 b	30 c	0 c
Fusarium oxysporum f. sp. apii	42 b	5 d	1 c
Verticillium dahliae	49 b	0 d	1 c
Schizophyllum commune	38 b	0 e	2 c
Rhizoctonia solani	3 c	0 e	0 c

[a]Percentage based on colony growth on identical medium without H_3PO_3. Values are means of four or five replications. At a particular KH_2PO_4 concentration, values with the same letter are not significantly different according to Duncan's multiple range test ($P = 0.05$).

In each case it was seen that as the phosphate concentration was increased, the percent of inhibition of radial growth was reduced due to the presence of phosphonic acid . This was true of all seven genera of fungus as well as *Phytophthora cinnamomi*, where even the addition of 100X more phosphate diminished the reported inhibition from 100% to 90%.

In this light, the Coffey Report places undue emphasis upon the conflicting study **T.E. Dolan and M.D. Coffey 1988** Correlative in vitro and in vivo Behavior of Mutant Strains of *Phytophthora palmivora* Expressing Different Resistances to Phosphorous Acid and Fosetyl-Na. PHYTOPATHOLOGY 78:974-978. This article (Dolan & Coffey) presents data where tomato seedlings were inoculated with *Phytophthora*

palmivora to assess the effects of increasing phosphate content upon fungal infection rate. The relevant results are shown in Table 4 of Dolan & Coffey:

TABLE 4. Effect of 1 or 10 mM potassium phosphate levels on the percent inhibition of infection of tomato seedlings treated with phosphorous acid (H_3PO_3) or fosetyl-Na and inoculated with either the parental isolate of *Phytophthora palmivora* (PO376) or a mutant strain (L3) exhibiting high resistance to H_3PO_3

Treatment (PO_3 meq/L)[x]	Phosphate level (mM)	Percent inhibition of infection[y] PO376 H_3PO_3	PO376 Fosetyl-Na	L3 H_3PO_3	L3 Fosetyl-Na
0.85	0	57 d	6 g	17 f	0 c
2.43		100 a	36 e	59 c	0 c
6.10		100 a	100 a	71 b	2 c
0.85	1	72 c	19 f	39 e	3 c
2.43		100 a	42 d	48 d	4 c
6.10		100 a	99 a	73 b	3 c
0.85	10	87 b	69 c	45 de	39 b
2.43		100 a	91 b	75 b	45 a
6.10		100 a	100 a	82 a	45 a

[x] Bare-rooted seedlings were placed in solutions of H_3PO_3 and of fosetyl-Na with 0, 1, or 10 mM potassium phosphate buffer and inoculated immediately with zoospores. Four days after inoculation, the stem of each seedling was plated in 0.5-cm segments on PARP medium to determine percent infection. Values with the same letter are not significantly different according to Duncan's multiple range test ($P = 0.05$).

[y] Values for PO_3 meq/L were determined by dividing micrograms per milliliter by the conversion factors: 82 (H_3PO_3) or 132 (fosetyl-Na).

These results seem to controvert what Fenn & Coffey showed in their Table 4, specifically, by showing that the addition of phosphate improves inhibition, at least against *P. palmivora*. Dolan & Coffey noted the discrepancy with the results obtained from the similar study by Fenn & Coffey, concluding on page 977 that more research is warranted:

> The enhanced level of control of *P. palmivora* in vivo in the presence of increasing levels of phosphate was unexpected. It contradicted findings obtained with the interaction between *P. cinnamomi* and *Persea indicia*, where phosphate was shown to reduce the efficacy of both compounds [here citing the work by Fenn and Coffey]. This indicates that phosphate influence on host and fungal metabolism may be an important factor affecting the efficacy of phosphonate fungicides. The

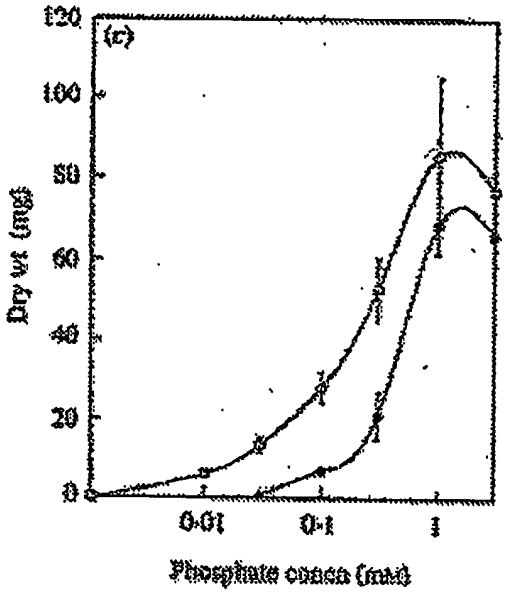
> relationship between phosphate concentration in tissues host parasite metabolism, and the mode of action of phosphonate fungicides could be complex. *There is need for additional research in this area to clarify the role of the host in these interactions* [emphasis added].

Dr. Coffey has failed to consider an important additional article that controverts his opinion as to obviousness. Where Dolan & Coffey in 1988 observed a discrepancy and recommended follow-on research, Dr. Coffey and others eventually performed that research. and reported this in 1993. Dr. Coffey chose not to consider this later work as a basis of his opinion in the Coffey Report. It is telling that the Coffey Report does not rely upon **J. M. Griffith, M.D. Coffey, and B.R. Grant 1993,** "Phosphonate inhibition as a function of phosphate concentration in isolates of *Phytophthora palmivora*," J. OF GENERAL MICROBIOL., 139: 2109-2116 (Griffith, Coffey &Grant).

Griffith, Coffey & Grant cites both the Fenn & Coffey article and the Dolan & Coffey articles that are discussed above. Griffith, Coffey & Grant report results obtained from the same *P. palmivora* organism that was also the subject of the Dolan & Coffey work. Careful examination of Griffith, Coffey & Grant reveals why it was excluded from the basis of opinion, i.e., it controverts the opinion.

Griffith, Coffey & Grant investigated media ranging in phosphate concentrations up to 1 mM both with and without phosphonate. Both the control and the phosphonate media were studied over phosphate concentrations ranging from 0.01 to 1 mM. These are extremely dilute concentrations of phosphate and phosphonate. Fig. 3 of Griffith, Coffey & Grant shows that the relative inhibition effect that is caused by combining phosphonate with phosphate diminishes towards 1 mM. Griffith, Coffey & Grant also discusses Fig.

1(c) with regard to a mutant *P. palmivora* strain that is resistant to phosphonate, where Fig. 1(c) is replicated below:



Griffith, Coffey & Grant state in their discussion of Fig. 1c on page 2112 (discussing isolate P7228):

> However, at higher levels of phosphonate (0.3 mM and above) phosphonate was less inhibitory to growth, and resistance to the effects of this anion was clearly demonstrated.

The overall trend as to the diminishing inhibition effect with increasing phosphate content is true with respect for all isolates in the Griffin, Coffey & Grant study, which says on page 2113 that the upper limits for the observed effect were in the range of from 1 mM to 3 mM:

> However, when Pi_e (phosphate content in the media) did not limit growth, at 1 mM and 3 mM, the P376 and P7228 strains accumulated more Pi (internal phosphate content in the cells) . . . than P113)

It will be appreciated that the P376 strain is one of the two mutant strains resistant to phosphonates that Dolan & Coffey investigated, and that Griffin, Coffey & Grant reports a much more thorough investigation. In Dolan & Coffey, the levels of phosphate and phosphonate used were 10 mM and lower, which are also well below the concentrations that are claimed in the patents at issue.

Other work by Griffith, also not considered in the Coffey Report but which was cited by Griffith & Coffey, shows that the metabolic interaction is more complex than one might otherwise imagine. The following Table is copied from **J.M Griffith, R. H. Smillie, J.O. Nicre and B. R. Grant, 1989** Effect of phosphate on the toxicity of phosphonate in *Phytophthora palmivora*, ARCH. MICROBIOL 152:425-429

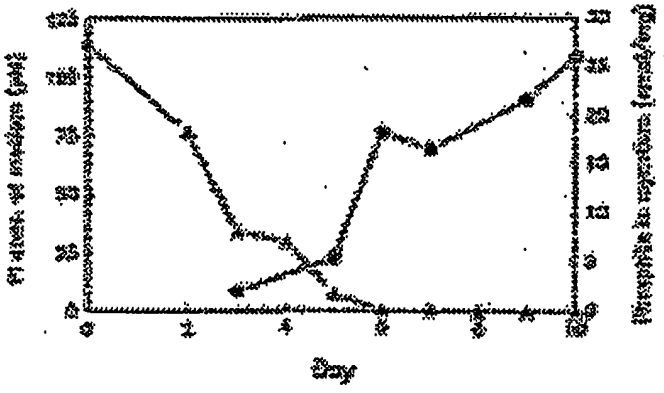


Fig 1. The uptake of phosphite and the utilization of P_i by *Phytophthora palmivora* during growth in LPR medium containing 1 mM phosphite. P_i and phosphite concentrations were determined by ion chromatography as described in Methods. P_i in medium (▲——▲); phosphite in mycelium (●——●)

Dr. Coffey was not an author of the foregoing article; however, Griffith, Coffey and Grant did cite this article, which explains the significance of Fig. 1:

> Analysis of the phosphite [phosphonate] content of the mycellium grown in LPR medium in the presence of 1 mM phosphite (the concentration used by Fenn and Coffey in q1984) showed that there was an abrupt increase in the level

> of phosphite entering the mycellium after Pi [phosphate] had been depleted from the medium at day 6 (Fig. 1).

This is shown above in Fig. 1 where the curve on the left hand side represents diminishing phosphate content in the growth medium, and the curve on the right hand side represents phosphonate that has entered the fungal cells of *P. palmivora*. At these concentrations, the phosphonate does not start to work until the phosphate is depleted. This explains, for example, why "[p]hosphates have also been considered to be a competitive inhibitor for phosphonate assimilation, thus inhibiting the ability of phosphonates to protect against fungus attack." U.S. 5,736,164, column 2, lines 32-34. But this is presented as a basis in support of patentability where the art shows generally that phosphates should not be mixed with phosphonates to achieve an antifungal effect.

The Coffey Report Fails To Consider The Concentrations That Are Claimed In Light Of What The References Teach, And Merely Assumes That The Concentrations Are The Same When In fact They Are Different

As shown above, in 1988 Dr. Coffey's own summation of the Dolan & Coffey results was that more research was needed. Yet today in 2005 he states unequivocally on page 13 of the Coffey Report:

> This enhancement effect was claimed as a discovery in U.S. Patent No. 5,736,164 ("the '164 patent") and the "837 Patent". But in fact this discovery was a clear example of prior art as published in Dolan and Coffey 1988 (PHYTOPATHOLOGY 78:974-978).

I disagree with Dr. Coffey's conclusion that the patents at issue claim what was reported in Dolan & Coffey. In my opinion, Dr. Coffey has reached this conclusion in a vacuum without first obtaining a basis for his opinion by resorting to the specific claim

language. In particular, it is necessary to ascertain what the claims mean before opining as to obviousness. Each of the patent claims in the '164 Patent requires the use of "enhanced fungicidally effective amounts." By way of example, claim 1 of the '164 patent recites "enhanced fungicidally effective amounts" and further provides that the two claimed salts are each present in solution from "about 20 millimole to about 5% v/v." Claim 2 recites "enhanced fungicidally effective amounts" and further provides that the ratio of salts is one part phosphonate to from 0.001 to 1000 parts by weight phosphate. The '164 patent Specification explains the "effective amounts" language, for example, in the passage from column 3 at line 66 to column 4 at line 3, which places the preferred minimum concentration as 20 mM. This is the minimum effective concentration that is taught by the Specifications in each of the patents at issue.

This 20 mM minimum represents an exemplary concentration that is indicative of what produces the claimed "effective amount." This represents an effect that differs in kind from what Dr. Coffey has observed in his work, where the effect observed by Griffin, Coffey & Grant is no longer an effect to observe at concentrations of 1 mM to 3 mM. The various references that Dr. Coffey has used in support of his opinion all investigate relatively dilute concentrations in comparison to what is claimed, especially where Griffith, Coffey & Grant reports that the effect under their study does not "limit growth" when phosphate concentrations exceed from 1 mM to 3 mM, depending upon the particular strain of *P. palmivora*.

Considering the body of references as a whole, there is no teaching or suggestion whatsoever that higher concentrations of phosphate would have any benefit, because they teach that the increase in concentration of phosphate is inhibitory to the mode of action of

the phosphonate anion. The art teaches away from the use of higher concentrations of phosphate that are claimed because these would inhibit the uptake of phosphonate by *Phytopthora* species.

Page 4 of the Coffey Report adopts a dictionary meaning to skew an interpretation of what acerbation means. The phenomenon is particularly described in each issued patent, for example, in column 2 at lines 15-21 of the '164 patent. The acerbation phenomenon pertains to the exacerbation or enhanced growth of non-target Ascomycete fungi. The effect that is claimed and is characterized by the 20 mM phosphate and phosphonate concentrations ameliorates the acerbation of Ascomycetes. This is a different problem than the one addressed by Dr. Coffey whose work dealt with *Phytopthora* (Phycomycetes). This is further evidence that Dr. Coffey has not consulted the patents at issue to ascertain the meaning of the "effective amounts" language in each of the claims at issue.

The foregoing facts teach those skilled in the art that they should not do what is claimed. First, this is because the art teaches that the concentrations should not exceed about 1 mM to 3 mM, where this produces an effect that differs in kind with respect to the effect that is produced by the higher concentration that are claimed. Second, the uptake studies by Griffith confirm that phosphate at these concentrations inhibits phosphonate activity.

The Coffey Report Reaches Erroneous Conclusions As To The '164 Patent and the '041 Patent Because The Art Teaches Away From Combining Phosphate with Phosphonate At the Concentrations That Are Claimed.

In describing his "[c]onclusions as to the '164 Patent and the '041 Patent, on page 17 of the Coffey Report, Dr. Coffey bases the conclusion as to obviousness on these points:

(i) potassium phosphonate was used as a fungicide to control *Phycomycetes*;

(ii) phosphonates were known not to control *Ascomycetes* fungi;

(iii) it was common practice to combine fungicides to control or inhibit growth of non-target fungi, such as the *Ascomycetes* where a phosphonate fungicide was used;

(iv) potassium phosphonates worked as fungicides to inhibit the growth of powdery mildews; and

(v) it was known that phosphates "did not necessarily" inhibit the efficacy of phosphonates and in some instances the phosphates may enhance the efficacy of the phosphonates.

Here it is appropriate to observe that point (iii) is loosely based upon inspecific teachings as to combining other fungicides, generally to achieve a broad spectrum effect; however, none of the references specifically suggest combining phosphates with phosphonates. The Coffey Report discusses this concept of generally combining fungicides in the paragraph bridging pages 14-15. The references that Dr. Coffey relies upon as a basis for his opinion have nothing to do with specifically combining phosphates and phosphonates, where it was equally understood in the art on the basis of Dr. Coffey's own work, for example, as shown in Griffith, Coffey & Grant, that some fungicides cannot be combined because they are incompatible with one another and that specifically phosphates should not be combined with phosphonates.

At the time of the invention and as shown above, it was generally thought to be the case that phosphates and phosphonates were incompatible fungicides. This was due to the inhibition effect that phosphate has upon phosphonate, for example, as shown by Fenn & Coffey or Griffith, Coffey & Grant. In essence, Dr. Coffey ignores this and commits a fundamental error when he says that the phosphonates were known to be effective against some *Phycomycetes* but not other fungi and phosphates were known to be effective against the other fungi (*Ascomycetes*) that were unaffected by phosphonates, so it made sense to combine them for efficacy against both types of fungi.

Dr. Coffey's proposition to combine phosphonates with phosphates at the claimed concentrations makes no sense from a perspective of skill in the art at the time of the invention. Dr. Coffey's own work and that of others teach against combining these two materials because the art shows that one inhibits the other at the concentrations which are claimed. This would produce precisely the opposite effect of achieving "broad spectrum biocides" that Dr. Coffey asserts are "typically" phosphonate fungicides on page 14 of the Coffey Report. It is not particularly relevant to the issue of nonobviousness whether today such formulations are 'typical.' That is the result of the invention that is claimed. Nonobviousness must be measured at the time of the invention, and at that time the art showed that phosphonates and phosphates should not be combined at the concentrations that are claimed because this would exacerbate a know problem. As stated on page 14 of the Coffey Report, "[l]ack of control these [sic.] 'non-target' fungi is inevitable and expected when a target-specific compound such as phosphonate is used." Thus, at the higher concentrations that are claimed, phosphate should not have been useful against *Ascomycetes* when phosphonate is used against *Phytophthora*. The Foliar

patents at issue do show that the combined use at higher concentrations is useful towards these ends. The distinction is nonobvious where the art teaches away from what is claimed.

Pages 15-17 of the Coffey Report identify work by Reuveni and coworkers as showing that phosphate can be used to control powdery mildew. These articles pertain to phosphate alone and do not address the problem of combining phosphonates with phosphates.

In Concluding That The Claims of The '837 Patent Are Obvious, The Coffey Report Takes An Inconsistent Position With Respect To Earlier Portion Of The Report.

Pages 17-18 of the Coffey Report concludes that it was well known in the art that phosphonates could serve as fertilizers, albeit poor fertilizers, so it would have been obvious to combine the two different types of fertilizers. Besides, Dr. Coffey argues, trace amounts of phosphonate are present in phosphate fertilizers that have been produced by acidulation, so the combination has been known for half a century. I disagree with this conclusion in many aspects.

The reasoning in support of the conclusion makes no sense. There can be no obviousness unless the prior art teaches or suggests what is claimed. This portion of the Coffey Report admits that phosphonate is a poor fertilizer, so the conclusion is deficient because it fails to explain why those skilled in the art would want to replace a better phosphate fertilizer with a poor one. The conclusion conflicts with page 10 of the body of the Report, which states "Plants cannot utilize PO_3." Dr. Coffey is saying that those

skilled in the art would want to do what is claimed because they would want to accomplished something he admits cannot be accomplished.

Dr. Coffey again misses the point by failing to consider the art that is before him. The '164 patent cites, for example, United States Patent No. 5,514,200 to Lovatt to show that phosphonates do, indeed, have fertilizer effects, but are not traditionally mixed with fertilizers:

> Until recently, phosphate and polyphosphate compounds were considered the only forms in which phosphorus could be supplied to plants to meet the plant's nutritional need for phosphorus. Indeed, the only phosphite compound cited for use as a fertilizer in the Merck Index (M. Windhols, ed., 1983, 10th edition, p. 1678) is calcium phosphite ($CaHPO_3$). No phosphite fertilizer formulations are listed in The Farm Chemical Handbook (Meister Publishing Co., 1993, Willoughby, Ohio 834 p.) or Western Fertilizer Handbook (The Interstate, Danville, Ill. 288 p.) Historically, calcium phosphite was formed as a putative contaminant in the synthesis of calcium superphosphate fertilizers [McIntyre et al., Agron. J. 42:543-549 (1950)] and in one case, was demonstrated to cause injury to corn [Lucas et al., Agron. J. 71:1063-1065 (1979)]. Consequently, phosphite was relegated for use only as a fungicide (Alliete.RTM.; U.S. Pat. No. 4,075,324) and as a food preservative.
>
> More recently, it has been shown that plants can obtain phosphorus from phosphite [Lovatt, C. J., Mar. 22, 1990, "Foliar phosphorus fertilization of citrus by foliar application of phosphite" In: Citrus Research Advisory Committee (eds) Summary of Citrus Research, University of California, Riverside, Calif. pp 25-26; Anon., May, 1990, "Foliar applications do double duty" In: L. Robison (ed) Citrograph Vol. 75, No. 7, p 161; Lovatt, C. J., 1990, "A definitive test to determine whether phosphite fertilization can replace phosphate fertilization to supply P in the metabolism of `Hass` on `Duke 7`:--A preliminary report" California Avocado Society Yearbook 74:61-64; Lovatt, C. J., 1992]. Formulations based on phosphorous acid and hypophosphorous acid, as phosphite is, generally undergo oxidation to phosphate and thus lose the benefits that could be derived from the use of phosphite fertilization applications.

In discussing his own work at the dilute concentrations, Dr. Coffey on page 12 of the Coffey Report describes the fertilizer approach of the '837 patent as an "attempt to avoid this prior art." He dismisses the approach as baseless:

> Suffice it to say that there is no valid and reputable published information in the scientific literature to support their claim. To the contrary all the published information clearly indicates that plants cannot utilize P in the form of PO_3 ($H_2PO_3^-$ or HPO_3^{2-}).

Dr. Coffey concludes that PO_3 may persist as a fungicide "for weeks or even months" but conveniently overlooks what gradually happens to the phosphonate at the conclusion of those weeks or months. It turns into phosphate, which he admits is a fertilizer. This timing has particular advantages in fertilizer use.

Yet the '200 patent to Lovatt teaches against the combination where, "[t]he present invention provides phosphorus fertilizers essentially devoid of phosphate." U.S. 5,514,200, column 3 at lines 46-47. Thus, Dr. Coffey has concluded that those skilled in the art would want to use as a fertilizer phosphonate compositions that have been relegated for use as antifungals, and where despite his error the phosphonates may be used as fertilizers except the art teaches they should not be used in combination with phosphates. Lovatt expressly teaches that the combination should not be made for use as a fertilizer.

The dilute concentrations of phosphonate 'contaminants' that were used and observed by McIntyre do not fall within the scope of the concentrations that are claimed, so the inventive composition that is claimed has not been known for more than half a century. The claims are nonobvious.

The Coffey Report Takes Inconsistent Positions As To the Breakdown of Fosetyl Aluminum And The Equivalency Of This Substance With Respect To Potassium Phosphonate

I disagree with certain statements presented in the Coffey Report to the extent that such remarks seem intended to equate alkyl phosphonates, such as fosetyl-Al, with phosphonic acid and the phosphonate salts exemplified by potassium phosphonate. The materials perform differently, for example, where Fenn & Coffey 1984, PHYTOPATHOLOGY 74:606-611 on page 610 reports that the EC_{50} values (a toxic does study) in various Phytophthora isolates ranged from 0.03 to 0.07 PO_3 meq/L where H_3PO_3 was used, but this compares to 0.38 to 0.45 PO_3 meq/L in the case of fosetyl-Al (aluminum ethyl phosphonate).

Page 4 of the Coffey Report, citing Ouimette, states that "phosphonate is the active fungicidal principle in plants irrespective of the original phosphonate material, whether it be aluminum ethyl phosphonate, sodium ethyl phosphonate, dimethyl phosphonate or ethyl phosphonate. In all cases they breakdown *immediately* [emphasis added] to phosphonate." The very next paragraph explains "the interference of phosphate with phosphonate activity can be much more pronounced with ethyl phosphate used as a fungicide (Fenn & Coffey 1984, PHYTOPATHOLOGY 74:606-611)." It would not be possible to observe this type of "interference" if the effect were truly *immediate*.

The Coffey Report does not clarify where this breakdown occurs. Dr. Coffey's own publications state that the breakdown occurs in the soils and/or plants: See: Cohen & Coffey 1986, "Systemic Fungicides and the Control of Oomycetes," ANN. REV. PHYTOPATHOL. 24:311-38, pg. 319, 4th paragraph, "Fosetyl Al breaks down rapidly in soils and plant tissues." Based on the Ouimette reference that is relied upon in the Coffey Report (Ouimette Thesis, page vi), the breakdown occurs in either the soil or plant tissue after treatment with aluminum ethyl phosphonate. Page 1 of Ouimette in the

second sentence, and page 70 in the first sentence, both substantiate where the breakdown occurs i.e. in soils or in the plant cell. Thus, it should not be concluded that the so-called *immediate* breakdown occurs in solution before application to a plant.

Although the Fenn & Coffey and Dolan & Coffey references do show that fosetyl-Al behaves similarly in some respects to phosphonic acid, it is also the case that fosetyl-Al is less effective than phosphonic acid and as a regulated fungicide fosetyl-Al is in a different class of material with regard to toxicity.

Dr. Coffey Previously Considered The Patentability of His Own Work That He Now Cites As A Bar To The Patents At Issue And Concluded That It Was Not Patentable, But The Patent Office Takes A Different View.

As discussed above, when the entire body of art is considered as a whole this teaches away from what is claimed in the patents at issue, at least because of the interference inhibition by phosphate upon phosphonate activity. In describing his own work including the Dolan & Coffey article in the paragraph bridging pages 4-5, Dr. Coffey himself admits this is the case and that the references are contradictory:

> In summary, we concluded that phosphate may have a negative, positive or neutral effect on phosphonate activity. Also, the interference of phosphate with phosphonate activity can be more pronounced with ethyl phosphonate as compared to phosphonate used as a fungicide [here admitting that interference occurs in both cases].

It will also be remembered that Dr. Coffey concluded his own Dolan & Coffey article on page 977 merely with a recommendation that there "is need for additional research." In summary, they had not solved the problem that is addressed by what is claimed in the Foliar patents at issue.

The Coffey Report argues obviousness from a hindsight position that differs between then and now. Page 12 of the Coffey Report admits that he did not consider patenting his own work in the 1980's, i.e., "[w]e did not consider patenting these discoveries as in our opinion the prior art of Thizy and others at RP precluded this legal process [citing articles through 1989]." The next paragraph on page 12 of the Coffey Report characterizes the work of Lovatt by implication:

> Suffice it to say that there is no valid and reputable published information in the scientific literature to support their claim. To the contrary all the published information clearly indicates that plants cannot utilize P in the form of PO_3 (H_2PO_3- or HPO_3^{2-}) , phosphonate, phosphite) as a source of nutrition.

Despite the criticism, Dr. Lovatt is an esteemed and reputable researcher. It is further telling that Dr. Coffey does not apply Thizy against the claims at issue, because this was supposedly the basis for assessing that his own work from the 1980's was unpatentable. Page 13 of the Coffey Report shows that Dr. Coffey uses primarily Dolan & Coffey (1988) and asserts that the '164 and '837 patents claim the discovery that is reported therein. Dr. Coffey admits that he considered the patentability of the Dolan & Coffey results and previously concluded that they were unpatentable.

If what is shown in Dolan & Coffey is unpatentable then there must be some difference in scope between what is claimed in the Foliar patents and what is taught by Dolan & Coffey. The Patent Office shares this view. Foliar placed Thizy, Dolan & Coffey and the Reuveni references before the Patent Office in subsequent reexamination proceedings for the '164 and '837 patents. The Patent Office determined that the claims were allowable over this art. PFS has since requested yet another reexamination to have the Patent Office reconsider that position, and that proceeding is now underway.

The fact that the Patent office has considered the art which is relied upon by Dr. Coffey and determined that the claims at issue were patentable is evidence that controverts Dr. Coffey's conclusion. There has been an official determination that what Dr. Coffey says as to obviousness is untrue.

The Coffey Report Fails To Consider Evidence of Secondary Considerations of Nonobviousness

It has been reported to me that the commercial products which are protected by the claims at issue have achieved commercial success and for the reason that they solve the problems that are described in the specifications of the Foliar patents. This indicates nonobviousness where others would have been motivated to commercially exploit a solution if they had one. Another consideration is that the claimed invention solves a long felt need by overcoming a problem which others were unable to overcome. Dr. Coffey and others were investigating the problem, but had not solved it. This is evidenced by the art that is discussed above, especially where Dr. Coffey did not consider his own work to be patentable and merely recommended 'additional research' in concluding the Dolan & Coffey article. Dr. Coffey's own skepticism as to the fruits of this 'additional research' is confirmed by is own failure to seek patent protection after the subsequent work of Griffith, Coffey & Grant. In summary, the art that is relied upon in the Expert Report did not place those skilled in the art in possession of the invention, and Dr. Coffey now argues this reference selectively and in hindsight for a conclusion that was not ascertainable at the time of the invention.

CONCLUSION

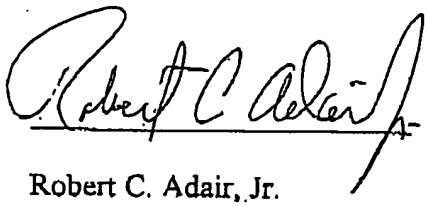
The claimed invention addresses a completely different concentration range than was reported by Dr. Coffey. His conclusions as to obviousness find no support in this art when it is realized that the claimed concentration range must completely overwhelm the effects of concentrations that are reported in his studies. In fact, the art teaches away from doing what he says is obvious. This is because there is no suggestion or motivation to "combine fungicides" at the claimed concentrations where the art teaches that the effect Dr. Coffey espouses would be overwhelmed at 3 mM. Besides, this effect as reported by Griffith & Coffey shows that there is no net inhibition effect relative to a totally untreated control. As to fertilizers, the art also teaches away from making the combination, but for the different reasons explained by Lovatt. These conclusions are affirmed by the secondary considerations of nonobviousness.

Other Patents In Suit

Dr. Coffey reserves the right to supplement for other patents in suit, and I reserve the right for rebuttal of such supplements.

Compensation

I am being compensated for my services at the rate of $100 per hour.



Robert C. Adair, Jr.